



Calibration Certificate Temperature

On site Calibration
Certificate nr: **DTA75012402-BY73**
Driftcon® Service License 2

Applicant

Institute / Client	Cyclertest
Department	training and support
Address	Rotcherweg 61
Zip / City	6374XE Ladngaarf
Country	Netherlands

On site location

Contact	Support
Address	Rotscherweg 61
Room	demo room 1 floor
Zip / City	6374 XW Landgraaf
Country	Netherlands
Phone	+31455338733
E-mail	

Tested instrument (DUT)

Manufacturer	Bio-Rad Laboratories
Instrument	CFX96 Opus Deepwell
Instrument serial number	CT011239
Block type	96-Deep Well
Block position	Center
Block serial number	RD031799
Internal reference	cycler_07

Calibration method

The temperature calibration is performed conform ISO 20836:2021 guidelines.

19 temperature sensors measure the temperature at different prescribed points in the sample block of the instrument and are monitored through an ITS-90 traceable measurement system. The sensors are positioned at the bottom of the measurement well. Measurements are made on all temperature sensors simultaneously at 4 Hz.

In addition to these bottom position sensors, 15 LED's (light emission diode) are positioned on top of the calibration unit. The LED emit light at the same prescribed points in the sample block of the real-time thermal cycler..

Pre-heat protocol

Step 1 : 30 °C for 60 seconds
Step 2 : 95 °C for 60 seconds
Step 3 : 30 °C for 60 seconds

Protocol

Step 1 : 30 °C for 60 seconds
Step 2 : 95 °C for 60 seconds
Step 3 : 30 °C for 60 seconds
Step 4 : 90 °C for 60 seconds
Step 5 : 50 °C for 60 seconds
Step 6 : 70 °C for 60 seconds
Step 7 : 60 °C for 60 seconds
Step 8 : 30 °C for 60 seconds

Instrument settings

During the calibration the instrument was set to Block mode (NOT calculated or simulated) and heated lid On, with the reaction volume set to 0 µl and ramp rate set to maximum.



Non conformities in method or environmental conditions

Calibration is performed according to a quality system procedure. No non conformities are reported.

Environmental conditions (average)

Ambient temperature	N/A
Relative humidity	N/A

Results

The results are given on the following pages of this certificate.

The measurement results of the average block temperature and block temperature uniformity are presented according to the ILAC P14 Policy for "Measurement Uncertainty in Calibration".

Uncertainty

The reported uncertainty of measurement (U) is based on the standard uncertainty of measurement multiplied by a coverage factor $k = 2$, which for a normal distribution corresponds to a coverage probability of approximately 95%. The standard uncertainty has been determined in accordance to 'Guide to the expression of uncertainty in measurement' (GUM).

Exclusions

1. All time related values like hold time, duration and ramp rate are excluded from the scope of accreditation.
2. The heated lid sensor is not calibrated and is excluded from any uncertainty statement provided in this certificate.

Traceability

The measurements have been executed using standards for which the traceability to (inter)national standards has been demonstrated towards the RvA. The Raad voor Accreditatie is one of the signatories of the Multilateral Agreement of the European Cooperation for Accreditation (EA) and to the ILAC Mutual Recognition Arrangement (MRA) for the mutual recognition of calibration certificates.

Calibration date

15-Jun-2026

Due date

June 2028

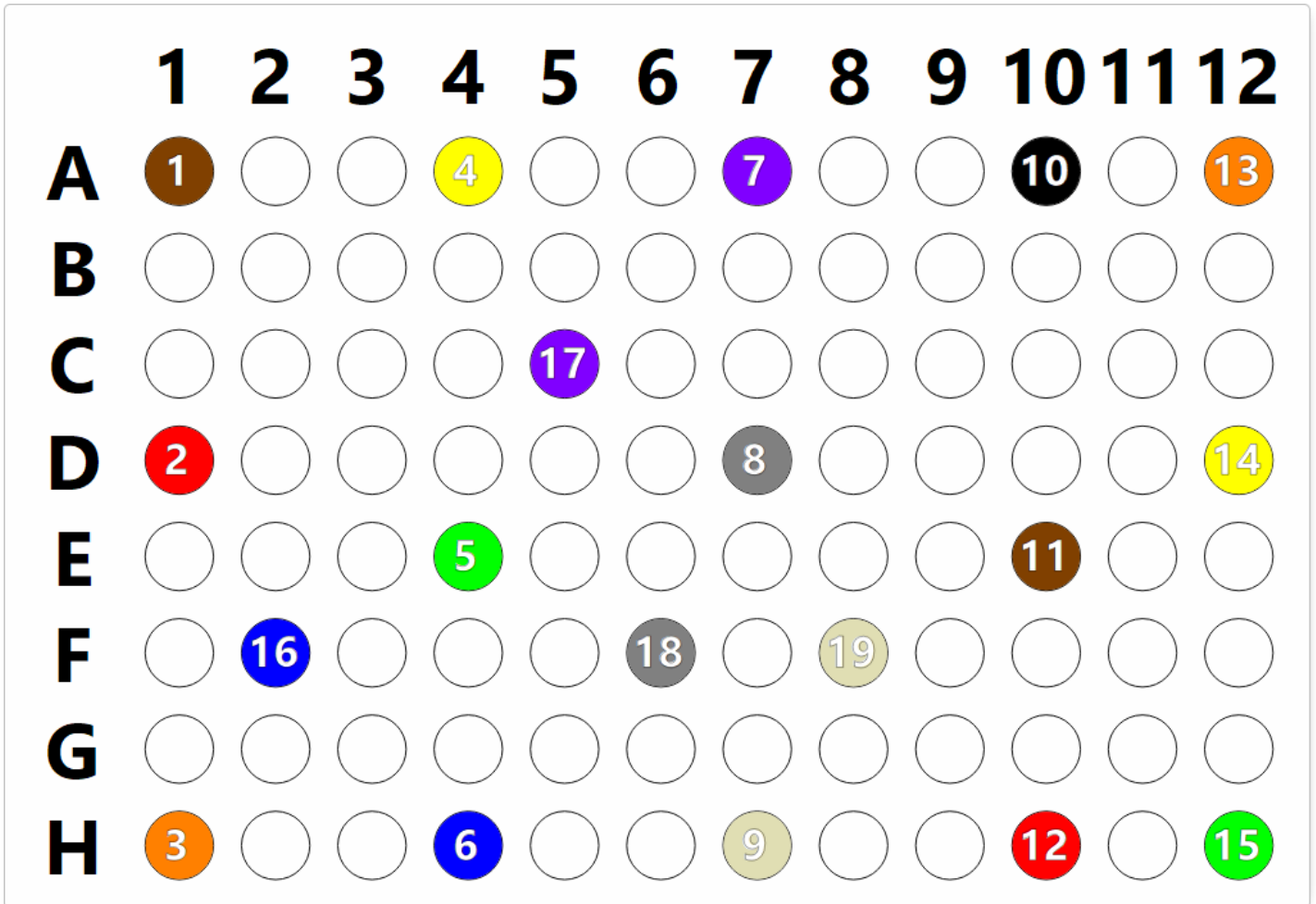
Report date

19-Jun-2026 08:52

Approved signatory

Mr. Tom Hendrikx
CEO

Reproduction of the complete certificate is allowed. Parts of the certificate may only be reproduced with written approval of the calibration laboratory. This certificate is issued provided that neither CYCLERtest BV nor the Raad voor Accreditatie assumes any liability.



- Sensor 1 in Well (A1)
- Sensor 2 in Well (D1)
- Sensor 3 in Well (H1)
- Sensor 4 in Well (A4)
- Sensor 5 in Well (E4)
- Sensor 6 in Well (H4)
- Sensor 7 in Well (A7)
- Sensor 8 in Well (D7)
- Sensor 9 in Well (H7)

- Sensor 10 in Well (A10)
- Sensor 11 in Well (E10)
- Sensor 12 in Well (H10)
- Sensor 13 in Well (A12)
- Sensor 14 in Well (D12)
- Sensor 15 in Well (H12)
- Sensor 16 in Well (F2)
- Sensor 17 in Well (C5)
- Sensor 18 in Well (F6)
- Sensor 19 in Well (F8)

Recommended control positions

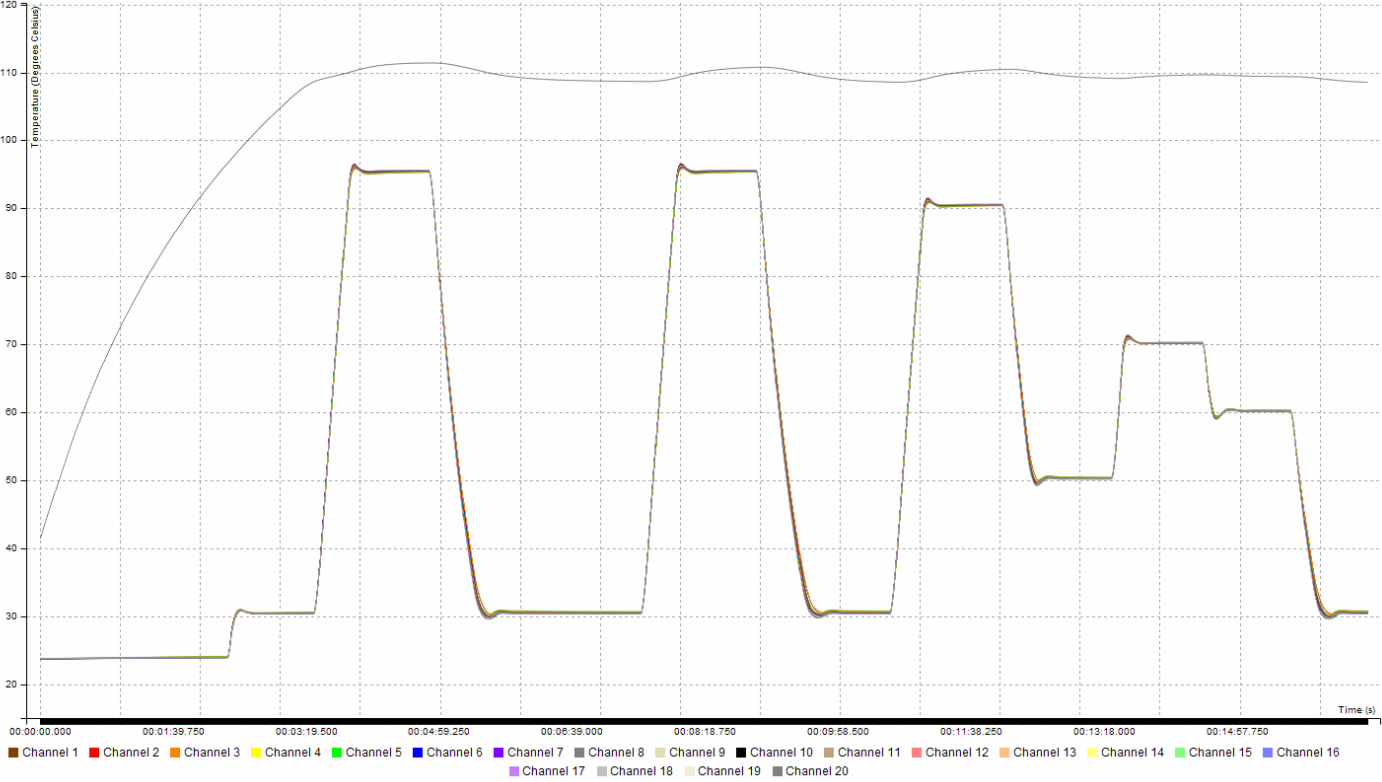
Positive H7 H1
 Negative H4 H12

Heated lid

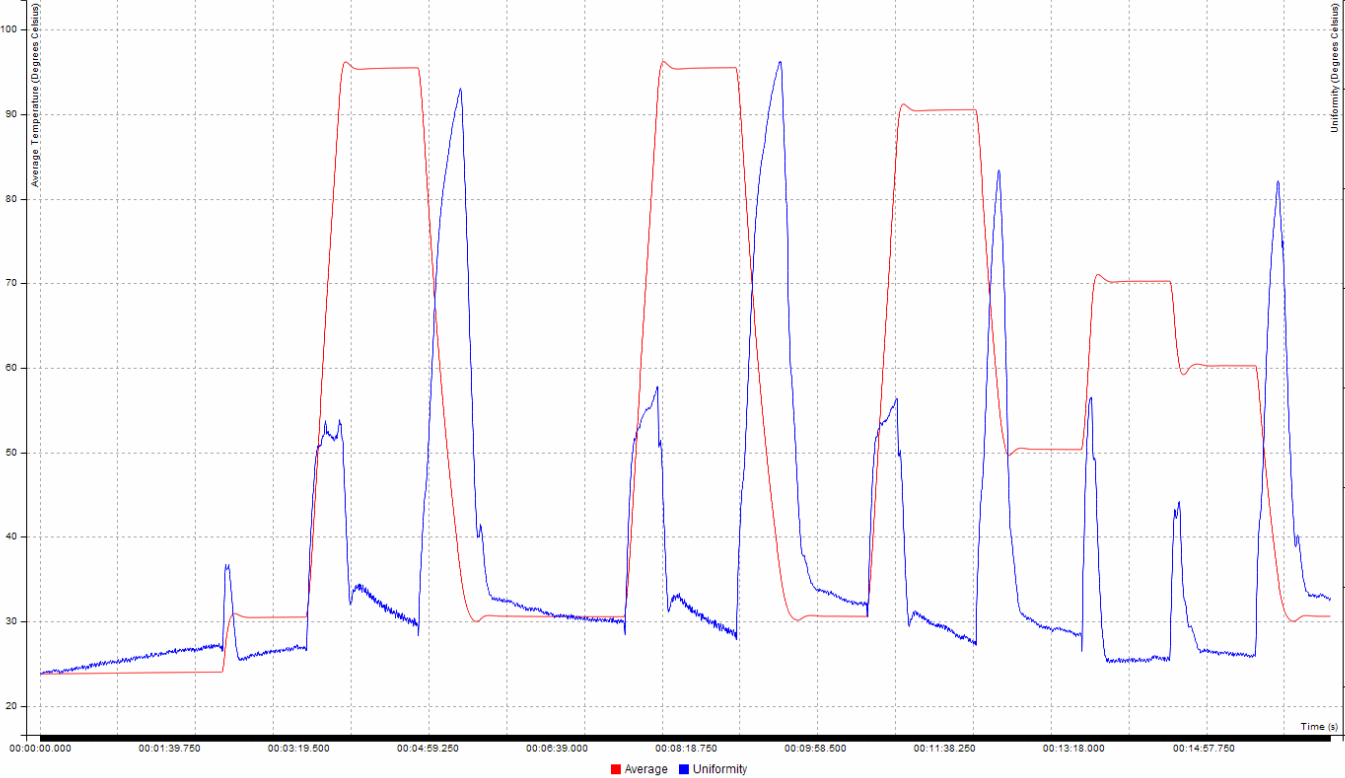
Heated lid sensor on top surface.



Overview chart



Uniformity chart





Static data overview

All data items are calculated @startpoint + 30 seconds

$t_{set}/^{\circ}\text{C}$	Hold time/s	$t_{average}/^{\circ}\text{C}$ ($t_{dev}/^{\circ}\text{C}$)	$t_{uniformity}/^{\circ}\text{C}$
95.0	59	95.4 (0.4)	0.4
30.0	61	30.6 (0.6)	0.5
90.0	59	90.5 (0.5)	0.3
50.0	60	50.3 (0.3)	0.3
70.0	59	70.2 (0.2)	0.1
60.0	59	60.2 (0.2)	0.2

Heated lid data overview

$t_{set}/^{\circ}\text{C}$	$t_{average}/^{\circ}\text{C}$	$t_{minimum}/^{\circ}\text{C}$	$t_{maximum}/^{\circ}\text{C}$
95.0	110.2	109.2	110.8
30.0	109.0	108.6	109.7
90.0	109.9	109.0	110.4
50.0	109.5	109.1	110.2
70.0	109.5	109.1	109.7
60.0	109.5	109.4	109.7

Ramp and dynamic uniformity data overview

$t_{transition}/^{\circ}\text{C}$	Ramp time/s	Ramp rate/ $^{\circ}\text{C}/\text{s}$ (max)	$t_{uniformity}/^{\circ}\text{C}$ (max)
30.0 - 95.0	29	+2.3 (+2.7)	1.2 (1.5)
95.0 - 30.0	40	-1.6 (-2.5)	2.2 (3.1)
30.0 - 90.0	26	+2.3 (+2.7)	1.2 (1.4)
90.0 - 50.0	24	-1.7 (-2.5)	1.7 (2.6)
50.0 - 70.0	10	+2.0 (+2.7)	1.1 (1.5)
70.0 - 60.0	8	-1.3 (-2.1)	0.7 (0.9)

Overshoot data overview

$t_{transition}/^{\circ}\text{C}$	Duration/s	$t_{overshoot}/^{\circ}\text{C}/\text{s}$ (max)	$t_{uniformity}/^{\circ}\text{C}$
30.0 - 95.0	5.0	96.2 (96.7)	0.7
95.0 - 30.0	6.0	30.2 (29.7)	0.4
30.0 - 90.0	5.0	91.1 (91.7)	0.7
90.0 - 50.0	7.0	49.6 (49.2)	0.7
50.0 - 70.0	6.0	71.0 (71.5)	0.8
70.0 - 60.0	7.0	59.2 (59.0)	1.1

Environmental conditions

	Ambient temperature ($t_{ambient}/^{\circ}\text{C}$)	Uncertainty ($U_{ambient}/^{\circ}\text{C}$)	Limits ($t_{ambient}/^{\circ}\text{C}$)	Relative humidity (RH/%rh)	Uncertainty ($U_{RH}/\%rh$)	Limits (RH/%rh)
Minimum	N/A	1.0	15.0	N/A	10.0	20.0
Maximum	N/A	1.0	27.0	N/A	10.0	80.0

Protocol run time

07m:40s



Static data step 2: 95.0 °C

Plateau start (startpoint) = 2026-Jun-15 14:24:56 (sample 2221), hold time = 59 s

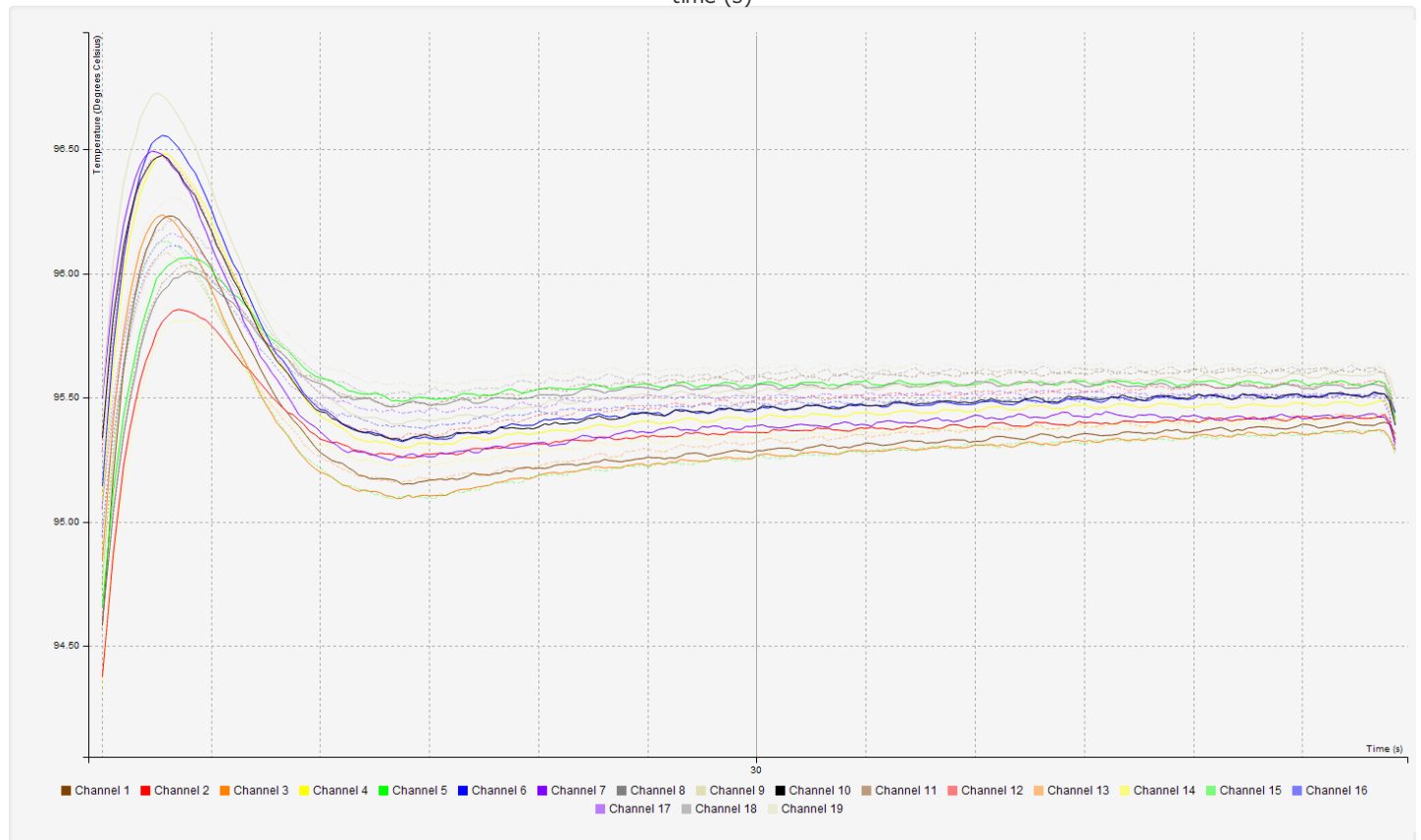
30 s ($t_{\text{sensor}}/^{\circ}\text{C}$)		
1	—	95.29
2	—	95.36
3	—	95.27
4	—	95.41
5	—	95.56
6	—	95.45
7	—	95.39
8	—	95.55
9	—	95.52
10	—	95.45
11	—	95.59
12	—	95.49
13	—	95.32
14	—	95.34
15	—	95.26 (-)
16	—	95.48
17	—	95.50
18	—	95.59
19	—	95.62 (+)

Calculated data

30 s ($t_{\text{sensor}}/^{\circ}\text{C}$)	
t_{average}	95.44
$t_{\text{uniformity}}$	0.36
$t_{\text{deviation}}$	0.44
U (Uncertainty)	0.34

Plateau chart 95.0 °C

time (s)





Static data step 3: 30.0 °C

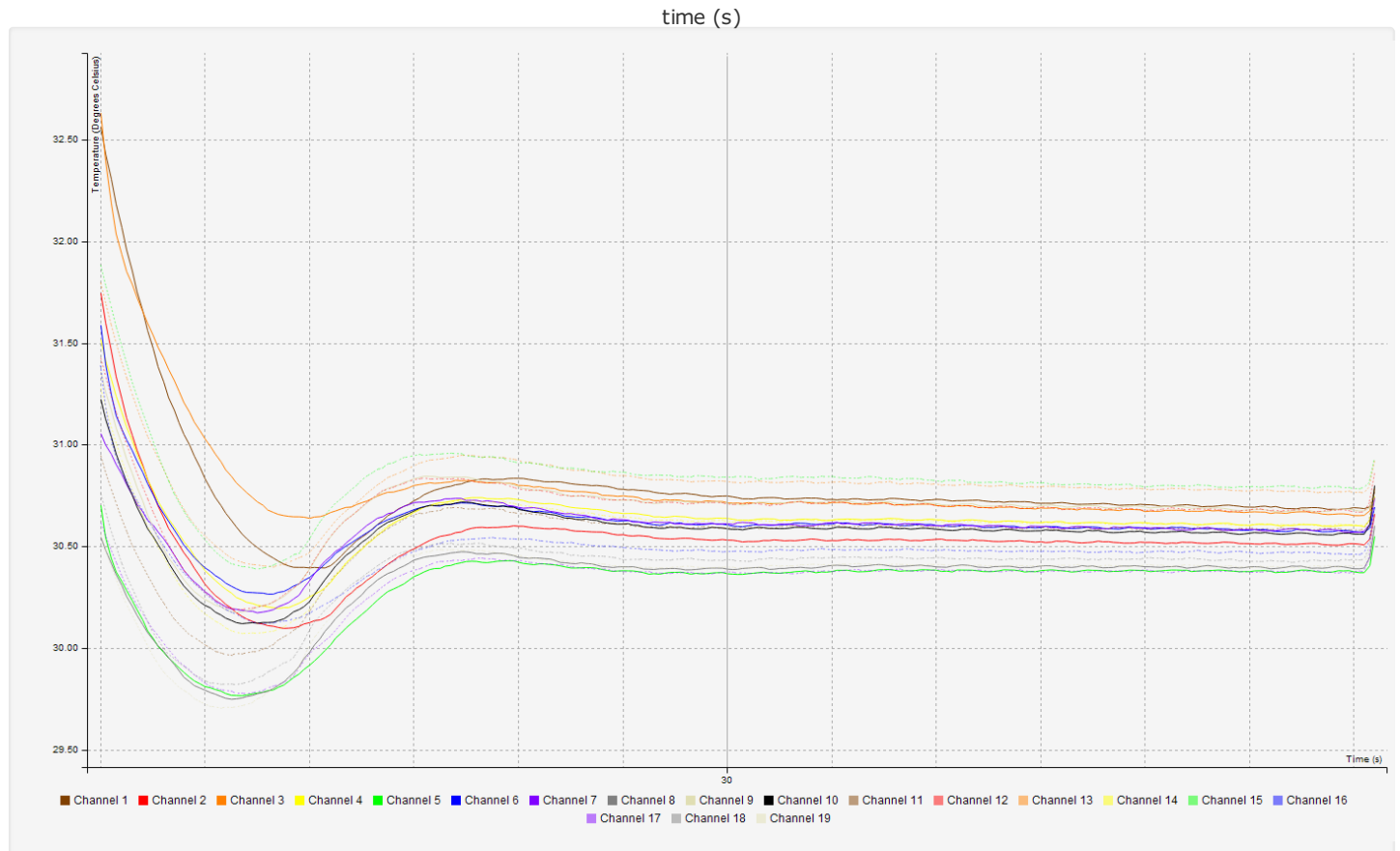
Plateau start (startpoint) = 2026-Jun-15 14:24:56 (sample 2617), hold time = 61 s

30 s ($t_{\text{sensor}}/^{\circ}\text{C}$)		
1	—	30.75
2	—	30.53
3	—	30.71
4	—	30.64
5	—	30.36 (-)
6	—	30.60
7	—	30.61
8	—	30.39
9	—	30.71
10	—	30.59
11	—	30.59
12	—	30.71
13	—	30.82
14	—	30.62
15	—	30.84 (+)
16	—	30.47
17	—	30.37
18	—	30.43
19	—	30.40

Calculated data

30 s ($t_{\text{sensor}}/^{\circ}\text{C}$)	
t_{average}	30.59
$t_{\text{uniformity}}$	0.48
$t_{\text{deviation}}$	0.59
U (Uncertainty)	0.39

Plateau chart 30.0 °C





Static data step 4: 90.0 °C

Plateau start (startpoint) = 2026-Jun-15 14:24:56 (sample 2961), hold time = 59 s

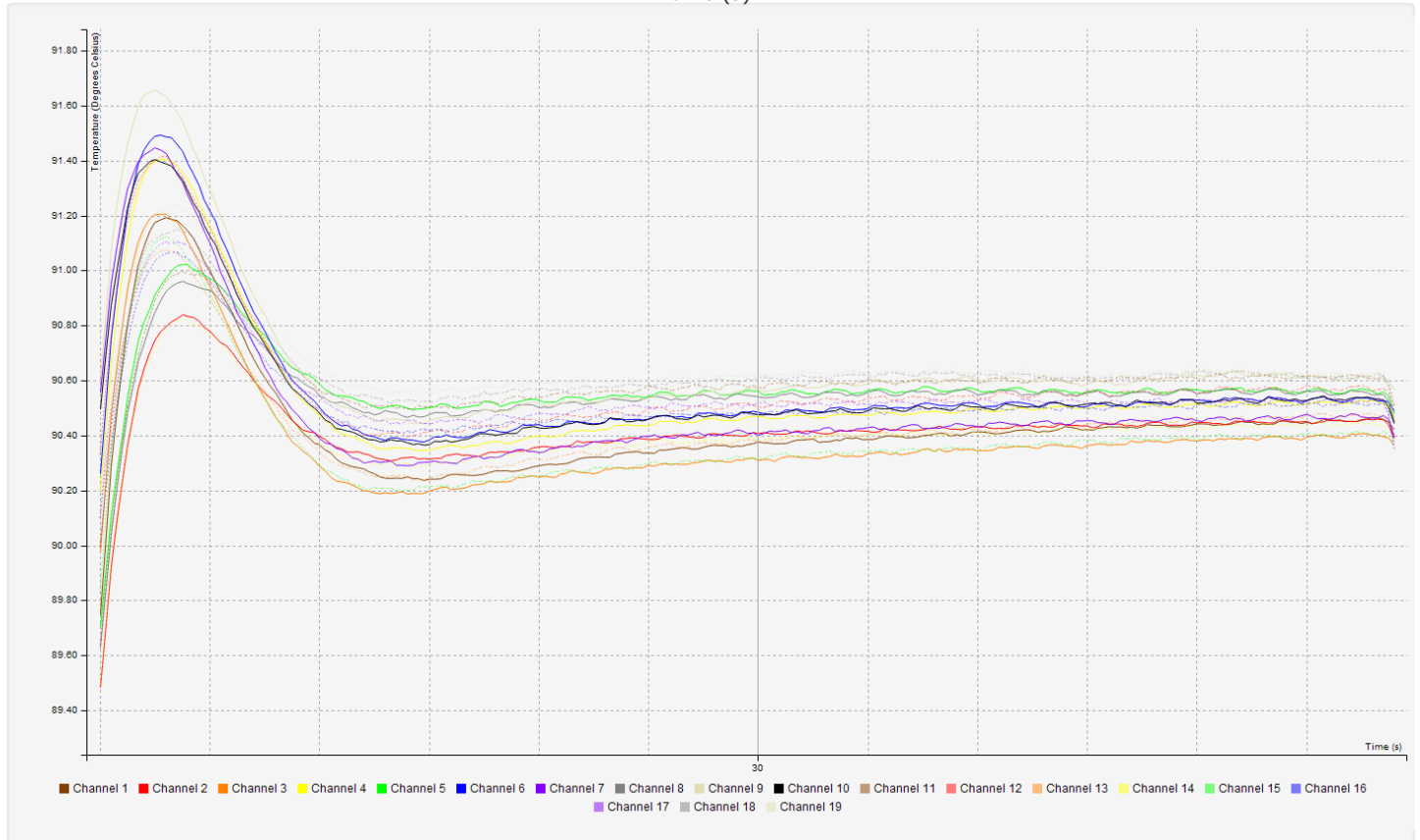
30 s ($t_{\text{sensor}}/^{\circ}\text{C}$)	
1	90.38
2	90.41
3	90.31 (-)
4	90.47
5	90.56
6	90.48
7	90.40
8	90.54
9	90.57
10	90.48
11	90.58
12	90.50
13	90.38
14	90.38
15	90.31 (-)
16	90.48
17	90.52
18	90.61
19	90.62 (+)

Calculated data

30 s ($t_{\text{sensor}}/^{\circ}\text{C}$)	
t_{average}	90.47
$t_{\text{uniformity}}$	0.32
$t_{\text{deviation}}$	0.47
U (Uncertainty)	0.33

Plateau chart 90.0 °C

time (s)





Static data step 5: 50.0 °C

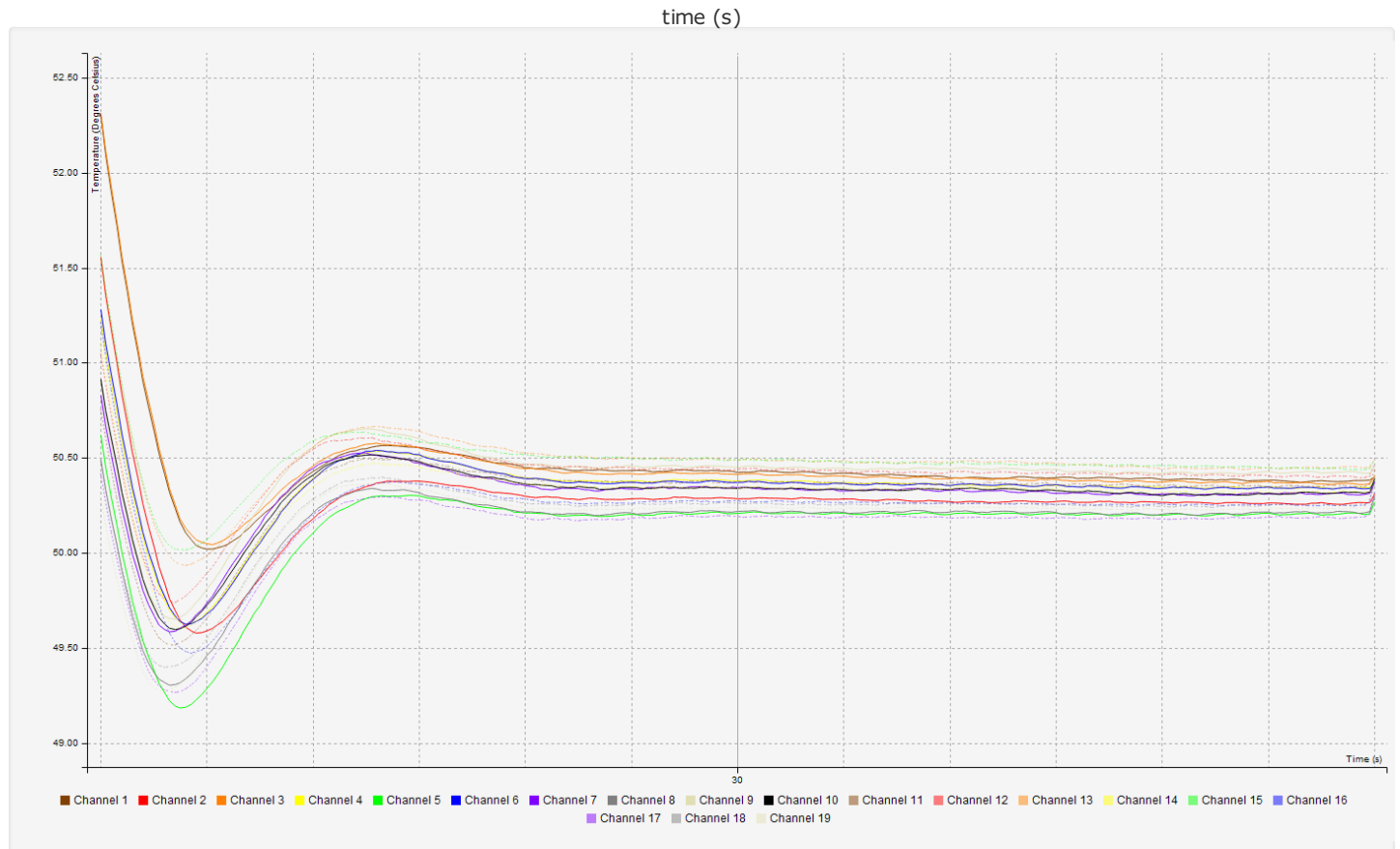
Plateau start (startpoint) = 2026-Jun-15 14:24:56 (sample 3284), hold time = 60 s

30 s ($t_{\text{sensor}}/^{\circ}\text{C}$)	
1	50.42
2	50.28
3	50.41
4	50.38
5	50.21
6	50.37
7	50.34
8	50.22
9	50.45
10	50.34
11	50.38
12	50.44
13	50.49 (+)
14	50.34
15	50.49 (+)
16	50.27
17	50.19 (-)
18	50.26
19	50.24

Calculated data

30 s ($t_{\text{sensor}}/^{\circ}\text{C}$)	
t_{average}	50.34
$t_{\text{uniformity}}$	0.30
$t_{\text{deviation}}$	0.34
U (Uncertainty)	0.32

Plateau chart 50.0 °C





Static data step 6: 70.0 °C

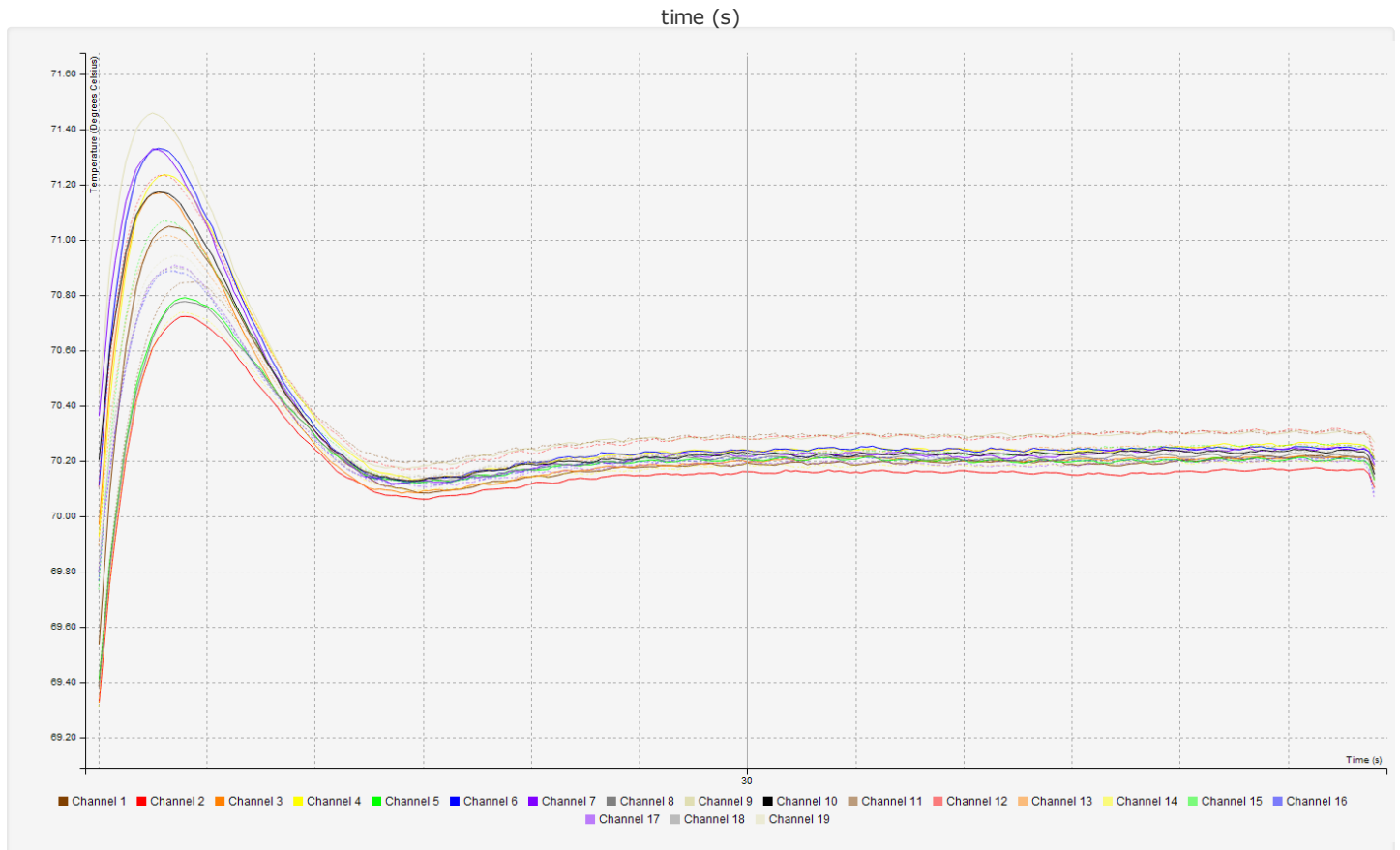
Plateau start (startpoint) = 2026-Jun-15 14:24:56 (sample 3561), hold time = 59 s

30 s ($t_{\text{sensor}}/^{\circ}\text{C}$)		
1	—	70.19
2	—	70.16 (-)
3	—	70.20
4	—	70.24
5	—	70.21
6	—	70.24
7	—	70.22
8	—	70.21
9	—	70.28
10	—	70.23
11	—	70.29 (+)
12	—	70.28
13	—	70.24
14	—	70.19
15	—	70.22
16	—	70.21
17	—	70.20
18	—	70.23
19	—	70.23

Calculated data

30 s ($t_{\text{sensor}}/^{\circ}\text{C}$)	
t_{average}	70.22
$t_{\text{uniformity}}$	0.13
$t_{\text{deviation}}$	0.22
U (Uncertainty)	0.28

Plateau chart 70.0 °C





Static data step 7: 60.0 °C

Plateau start (startpoint) = 2026-Jun-15 14:24:56 (sample 3824), hold time = 59 s

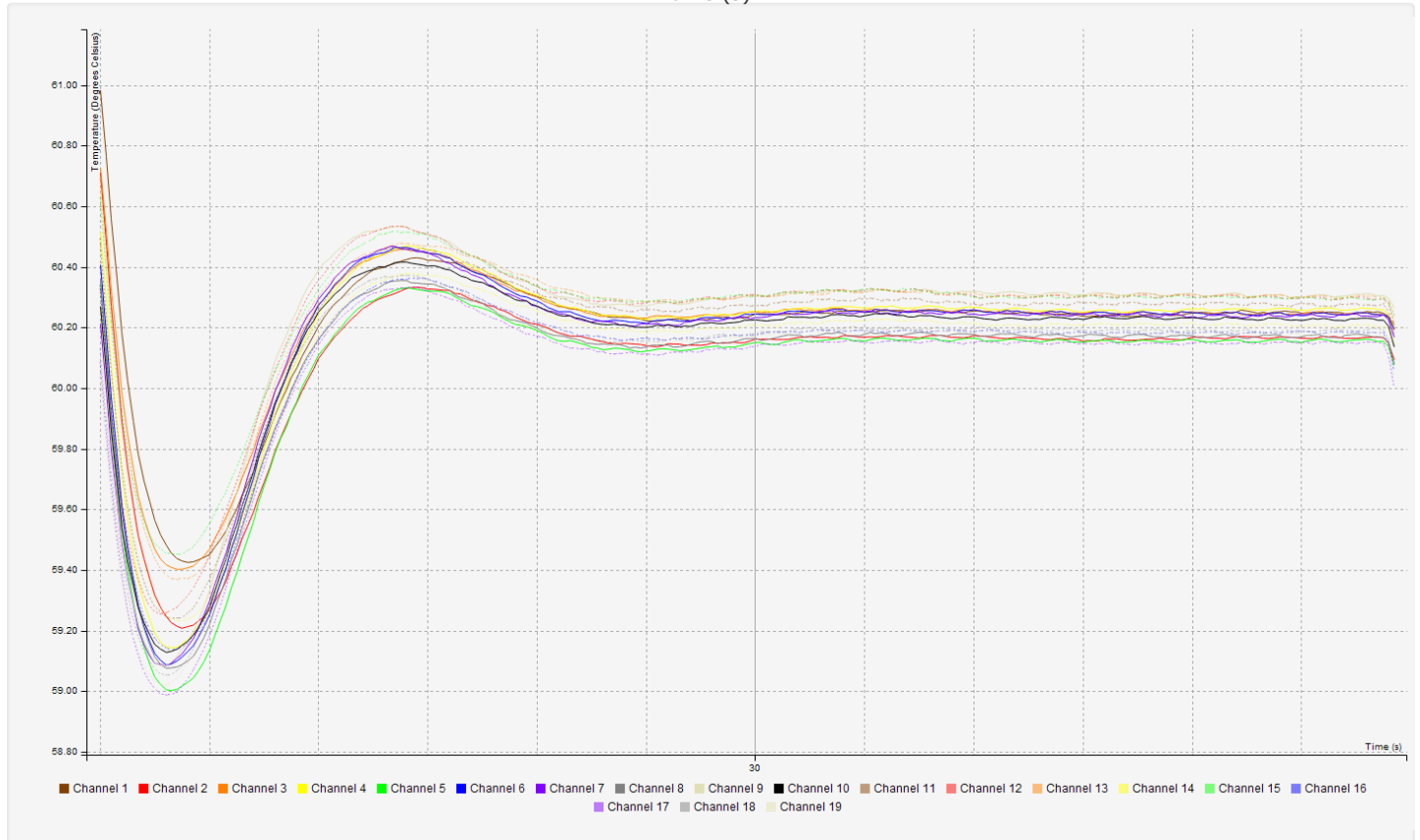
30 s ($t_{\text{sensor}}/^{\circ}\text{C}$)		
1	—	60.24
2	—	60.16
3	—	60.25
4	—	60.25
5	—	60.15
6	—	60.24
7	—	60.23
8	—	60.16
9	—	60.31 (+)
10	—	60.22
11	—	60.27
12	—	60.31 (+)
13	—	60.30
14	—	60.21
15	—	60.31 (+)
16	—	60.18
17	—	60.14 (-)
18	—	60.18
19	—	60.17

Calculated data

30 s ($t_{\text{sensor}}/^{\circ}\text{C}$)	
t_{average}	60.23
$t_{\text{uniformity}}$	0.17
$t_{\text{deviation}}$	0.23
U (Uncertainty)	0.29

Plateau chart 60.0 °C

time (s)





Terminology

$t_{average}$ [°C]	$t_{90}(avg)$, average value of all active sensors at a specific moment.
$t_{minimum}$ [°C]	Minimum value of all active sensors at a specific moment.
$t_{maximum}$ [°C]	Maximum value of all active sensors at a specific moment.
$t_{uniformity}$ [°C]	maximum temperature - minimum temperature at a specific moment. Other commonly used terms for uniformity are temperature spread or homogeneity.
$t_{deviation}$ [°C]	Average measured temperature (t_{90}) minus set temperature (t_{set}).
ramp rate [°C/s]	$dt/dtime$, where dt = between 10% and 90% of the ramp. $dtime$ = interval time ($t_{90\%}$) - time ($t_{10\%}$)
average overshoot [°C]	Average value of all active sensors at the moment of the maximum overshoot.
maximum overshoot [°C]	Maximum of all active sensors towards a static temperature hold.
overshoot duration [°C]	The time it takes for the plateau to reach the set temperature again.
set temperature [°C]	t_{set} , set or target temperature is the value which is programmed to be reached.
uncertainty [°C]	Parameter, associated with the result of a measurement, that characterizes the dispersion of the values that could reasonably be attributed to the quantity intended to be measured.
protocol run time [mm:ss]	The time it takes for the protocol to complete (pre-heat steps are not included).
hold time [s]	The measured time it takes for a plateau to complete.
ramp time [s]	The measured time it takes for an instrument to ramp from one temperature to another.
sample rate [Hz]	The number of samples taken per second.
DUT	Device Under Test The device under test which is the (real-time) thermal cycler.
CU	Calibration Unit The measurement system which is used for execution of the calibration (thermal and/or optical).
ND	Not Detected For reference, look at the plateau chart of the temperature involved.



Calibration information

Calibration number	TA75012402-BY73
Software version	Cyclertest Measurement Software 1.0.5.23629
Engineer	Stephanie Bracht (Kalibrierlabor)
Data filename	A75012402-BY73_20260615142447.cl2
Sample interval	250ms
QMS document	TBD
Measurement system uncertainty	0.25 °C (k=2)

Equipment information (CU)

Probe serial	A75012402
Probe type	GSOC Optical 96v15Plus4
Probe calibration date	31-Jul-2025
Probe calibration expire date	31-Jul-2026
Hardware box serial	A75012402
Hardware box version	0x0625
T-RH device serial	N/A
T-RH device calibration date	N/A

Disclaimer

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The (optical) calibration methodology and hardware are covered by patents owned by CYCLERtest BV.

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Control code

Go to <https://core.cyclertest.com/code/> to verify the data on this certificate.
Code: Q93DS-CTVNA-9G6CU-VXJ4P-CCPMZ-E
Or scan the QR code to go to the page directly.



Statement of Compliance *With Measurement Uncertainty Considered*

Status

Compliance reporting is **not performed** under ISO/IEC 17025 accreditation and is excluded from the scope of accreditation.

Scope

This document provides a decision statement regarding compliance of the calibrated/tested instrument with defined specifications, using a decision rule that includes measurement uncertainty in accordance with: ISO/IEC 17025:2017 (decision rule requirement), ILAC G8:09/2019 – Guidelines on the Reporting of Compliance with Specification, GUM – Guide to the expression of uncertainty in measurement.

Specification Reference

Generic specification Reference: Default Thermal Specifications

Source: CYCLERtest BV

CYCLERtest B.V. assumes no responsibility for the regulatory adequacy or suitability of the referenced specification.

Results

The statement of compliance is based on a 95% coverage probability for the expanded uncertainty of the measurement results on which the decision of compliancy is based. Detailed results are shown on the next pages

- COMPLIANT: The expanded uncertainty interval lies fully within the specification limits.
- NON-COMPLIANT: The expanded uncertainty interval lies fully outside the specification limits.
- CBD (Cannot Be Determined): The expanded uncertainty interval overlaps a specification limit.

CBD indicates that, based on the applied decision rule and reported uncertainty, conformity cannot be conclusively determined. No guard band applied unless explicitly stated.

Liability

CYCLERtest B.V. assumes no liability for the calibrated instrument being suitable for the intended use and generated results on the calibrated instrument, independent of the type of specifications used for the compliancy reporting.

Suitability for intended use of the calibrated instrument can be tested by running negative and weak positive control samples on the hottest and coldest positions of the block (see recommended control positions on page 3 of the respective certificate of calibration)

Approved Signatory

Tom Hendrikx, CEO



Addendum Calibration Certificate

On site Calibration
 Certificate nr: DTA75012402-BY73
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Plateau 95¹

Results

item ²	position ³	spec limits ⁴	reported value ⁵	uncertainty ⁶	compliance ⁷
t _{accuracy}	30	93.9 ≤ t ≤ 96.1	95.44	0.34	COMPLIANT
t _{uniformity}	30	0 ≤ t ≤ 1.5	0.36	0.25	COMPLIANT

Graphical

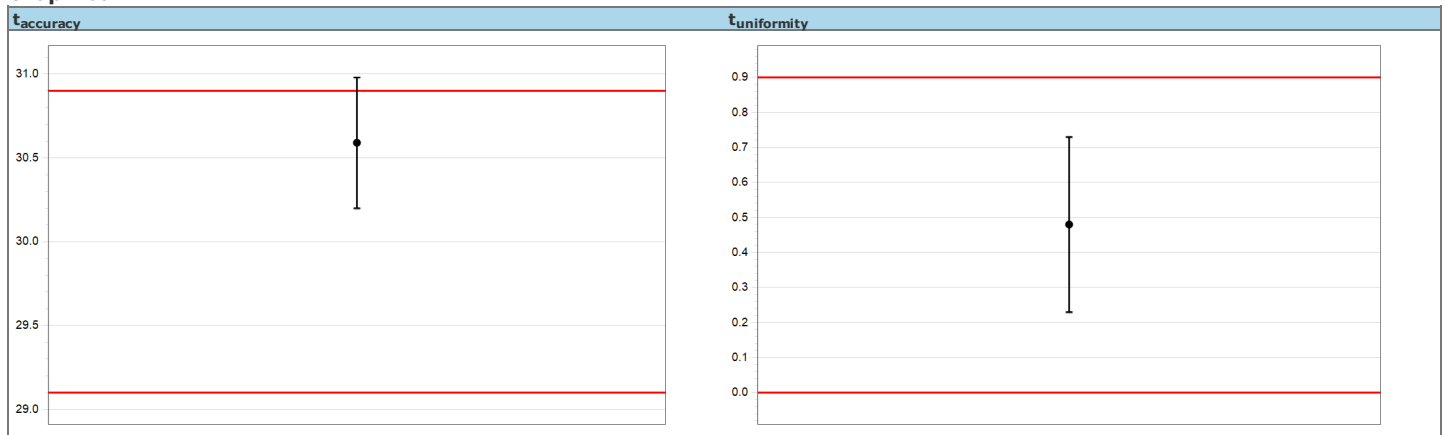


Plateau 30¹

Results

item ²	position ³	spec limits ⁴	reported value ⁵	uncertainty ⁶	compliance ⁷
t _{accuracy}	30	29.1 ≤ t ≤ 30.9	30.59	0.39	CBD
t _{uniformity}	30	0 ≤ t ≤ 0.9	0.48	0.25	COMPLIANT

Graphical





Addendum Calibration Certificate

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Plateau 90¹

Results

item ²	position ³	spec limits ⁴	reported value ⁵	uncertainty ⁶	compliance ⁷
t _{accuracy}	30	89 ≤ t ≤ 91	90.47	0.33	COMPLIANT
t _{uniformity}	30	0 ≤ t ≤ 1.3	0.32	0.25	COMPLIANT

Graphical

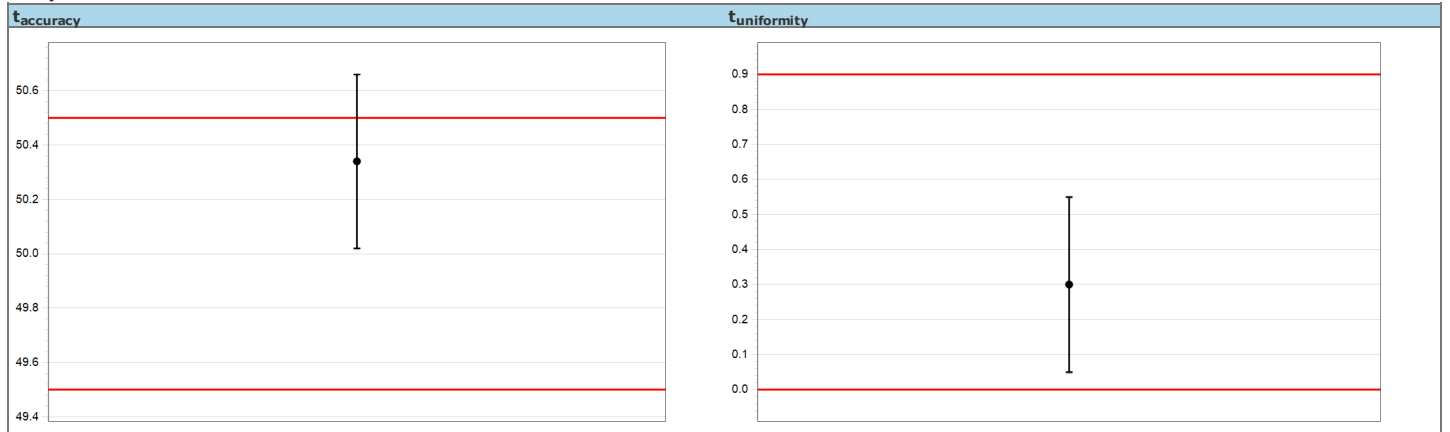


Plateau 50¹

Results

item ²	position ³	spec limits ⁴	reported value ⁵	uncertainty ⁶	compliance ⁷
t _{accuracy}	30	49.5 ≤ t ≤ 50.5	50.34	0.32	CBD
t _{uniformity}	30	0 ≤ t ≤ 0.9	0.3	0.25	COMPLIANT

Graphical





Addendum Calibration Certificate

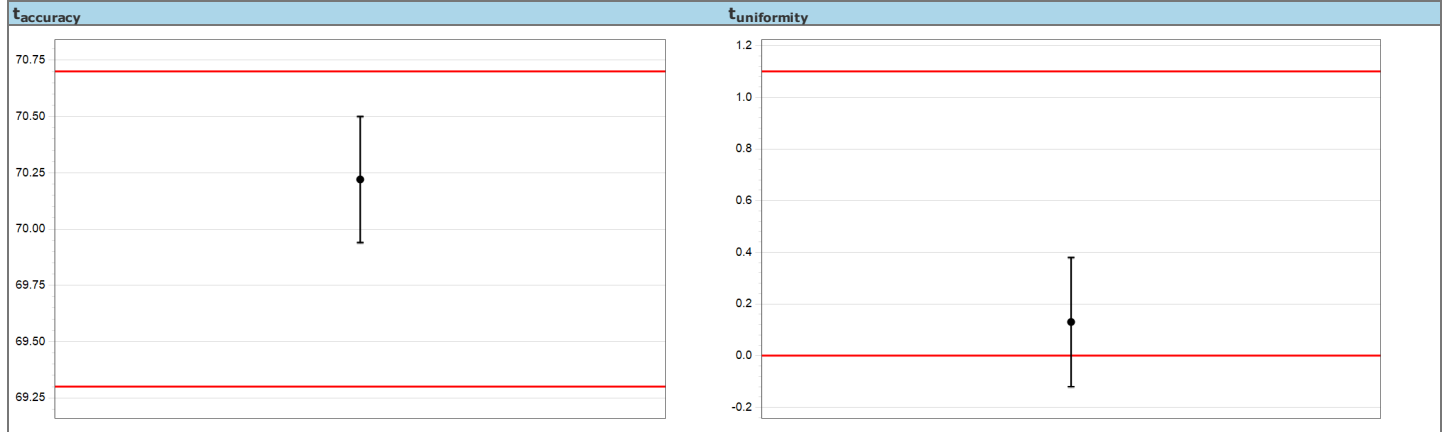
On site Calibration
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Plateau 70¹

Results

item ²	position ³	spec limits ⁴	reported value ⁵	uncertainty ⁶	compliance ⁷
t _{accuracy}	30	69.3 ≤ t ≤ 70.7	70.22	0.28	COMPLIANT
t _{uniformity}	30	0 ≤ t ≤ 1.1	0.13	0.25	COMPLIANT

Graphical

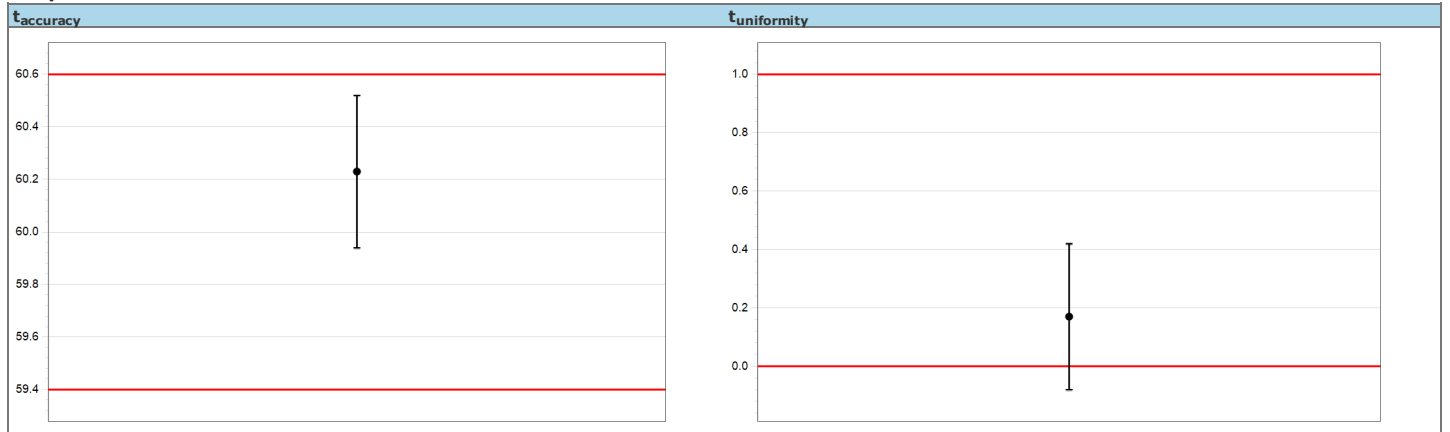


Plateau 60¹

Results

item ²	position ³	spec limits ⁴	reported value ⁵	uncertainty ⁶	compliance ⁷
t _{accuracy}	30	59.4 ≤ t ≤ 60.6	60.23	0.29	COMPLIANT
t _{uniformity}	30	0 ≤ t ≤ 1	0.17	0.25	COMPLIANT

Graphical



Addendum Calibration Certificate



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References and Terminology

1	t_{set} / °C
2	Specification type
3	Seconds from plateau start
4	Specification limits / °C
5	Value measured during calibration / °C
6	Reported uncertainty ($k=2$) / °C
7	Compliance to specification: <ul style="list-style-type: none">• COMPLIANT: The expanded uncertainty interval lies fully within the specification limits.• NON-COMPLIANT: The expanded uncertainty interval lies fully outside the specification limits.• CBD (Cannot Be Determined): The expanded uncertainty interval overlaps a specification limit.

CBD indicates that, based on the applied decision rule and reported uncertainty, conformity cannot be conclusively determined. No guard band applied unless explicitly stated.